ICP/EXT-04-00464
Revision 0

Remedy Performance Summary Report for the Final Groundwater Remediation Operable Unit 1-07B, Fiscal Year 2003

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September 2004

Idaho Completion Project

Bechtel BWXT Idaho, LLC

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Project No. 23339

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Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE/NE Idaho Operations Office
Contract DE-AC07-99ID13727

ABSTRACT

This report describes the overall performance of the groundwater restoration remedy at Operable Unit 1-07B at the Idaho National Engineering and Environmental Laboratory. This report also summarizes important activities completed this year for each of the three remedial action components included in this remedial action: (1) in situ bioremediation, (2) the New Pump and Treat Facility, and (3) monitored natural attenuation. Integration of the three components is discussed, as well as their combined effectiveness at remediation of the groundwater plume at Test Area North.

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ACRONYMS

AED	alternate electron donor
ARD	anaerobic reductive dechlorination
bls	below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
DCE	dichloroethene
DOE-ID	U.S. Department of Energy Idaho Operations Office
FY	fiscal year
ICDF	INEEL CERCLA Disposal Facility
ICP	Idaho Completion Project
INEEL	Idaho National Engineering and Environmental Laboratory
ISB	in situ bioremediation
MCL	maximum contaminant level
MNA	monitored natural attenuation
NA	not applicable
NPTF	New Pump and Treat Facility
OU	operable unit
PCE	tetrachloroethene
RAO	remedial action objective
TAN	Test Area North
TBD	to be determined
TCE	trichloroethene
TSDF	treatment, storage, and disposal facility
TSF	Technical Support Facility
VOC	volatile organic compound

Remedy Performance Summary Report for the Final Groundwater Remediation Operable Unit 1-07B, Fiscal Year 2003

1. INTRODUCTION

Operable Unit (OU) 1-07B at the Idaho National Engineering and Environmental Laboratory (INEEL) is the site of a trichloroethene (TCE) groundwater plume that extends nearly 2 mi from the historic TSF-05 injection well at the Test Area North (TAN) facility. Contaminants of concern (COCs) and preremedial action concentrations in the vicinity of TSF-05 are listed in Table 1. Because of the size of the plume and complexity of the site conditions, the remedial action was designed in a phased approach with three distinct technologies, including dechlorination of TCE and other chlorinated volatile organic compounds (VOCs), active groundwater extraction and treatment, and monitored natural attenuation (MNA). The three corresponding remedy components are referred to as in situ bioremediation (ISB), the New Pump and Treat Facility (NPTF), and MNA. Each component was designed with specific objectives to target distinct portions of the plume.

The purpose of this report is to present a summary of the overall performance of the OU 1-07B remedial action project. As required in the *Remedial Design/Remedial Action Scope of Work Test Area North Final Groundwater Remediation Operable Unit 1-07B* (DOE-ID 2001a), regulatory performance and compliance with remedial action objectives (RAOs)—as well as progress on project scope, schedule, and budget—will be reported on an annual basis for the next several years. Section 2 of this document presents the RAOs and describes each of the three remedial technologies and their integration. Section 3 summarizes the Fiscal Year (FY) 2003 technical performance of each remedy component. Section 4 provides a summary of the FY 2003 project scope, schedule, and budget activities.

Table 1. Contaminants of concern in the vicinity of the TSF-05 injection well.

Contaminant	Maximum Concentration Range[a]	Federal Drinking Water Standard
Volatile Organic Compounds		
TCE	12,000–32,000 ppb	5 ppb[b]
PCE	110 ppb	5 ppb[b]
cis-1,2-DCE	3,200–7,500 ppb	70 ppb[b]
trans-1,2-DCE	1,300–3,900 ppb	100 ppb[b]
Radionuclides		
Tritium	14,900–15,300 pCi/L[c]	20,000 pCi/L
Strontium-90	530–1,880 pCi/L	8 pCi/L
Cesium-137	1,600–2,150 pCi/L	119 pCi/L[d]
Uranium-234	5.2–7.7 pCi/L[c]	27 pCi/L[e]

a. The concentration range is taken from measured groundwater concentrations at the TSF-05 injection well (INEEL 2000) before remediation activities began in November 1998.
b. ppb is a weight-to-weight ratio that is equivalent to micrograms per liter (µg/L) in water.

Table 1. (continued).

c. Maximum concentrations of tritium and U-234 are below federal drinking water standards, and baseline risk calculations indicate cancer risk of 3×10^{-6}. While this risk is smaller than 1×10^{-4}, both tritium and U-234 are included as COCs as a comprehensive plume management strategy.
d. The maximum contaminant level for Cs-137 is derived from a limit of 4 mrem/yr cumulative dose equivalent to the public, assuming a lifetime intake of 2 L/day of water.
e. The federal drinking water standard for U-234 is for the U-234, U-235, and U-238 series.COC = contaminant of concern
DCE = dichloroethene
INEEL = Idaho National Engineering and Environmental Laboratory
PCE = tetrachloroethene
ppb = parts per billion
TCE = trichloroethene
TSF = Technical Support Facility

2. REMEDIAL ACTION SUMMARY

This section presents the OU 1-07B RAOs. It also includes a summary of each of the three OU 1-07B remedial components. The individual remedy performance reports discuss the performance details of each remedial component against its objectives.

2.1 Operable Unit 1-07B Remedial Action Objectives

The Agencies (i.e., U.S. Department of Energy Idaho Operations Office [DOE-ID], U.S. Environmental Protection Agency, and Idaho Department of Environmental Quality) have agreed to the following RAOs for the entire contaminant plume. These RAOs, specified in the *Record of Decision Amendment Technical Support Facility Injection Well [TSF-05] and Surrounding Groundwater Contamination [TSF-23] and Miscellaneous No Action Sites, Final Remedial Action* (DOE-ID 2001b), are as follows:

1. Restore the contaminated aquifer groundwater by 2095 (100 years from the signature of the *Record of Decision for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action* [DOE-ID 1995]) by reducing all COCs to below maximum contaminant levels (MCLs) and a 1×10^{-4} total cumulative carcinogenic risk-based level for future residential groundwater use and for noncarcinogens until the cumulative hazard index is less than 1.

2. For aboveground treatment processes in which treated effluent will be reinjected into the aquifer, reduce the concentrations of VOCs to below MCLs and a 1×10^{-5} total risk-based level.

3. Implement institutional controls to protect current and future users from health risks associated with (1) ingestion or inhalation of, or dermal contact with, contaminants in concentrations greater than the MCLs, (2) contaminants with greater than a 1×10^{-4} cumulative carcinogenic risk-based concentration, or (3) a cumulative hazard index of greater than 1, whichever is more restrictive. The institutional controls shall be maintained until concentrations of all COCs are below MCLs and until the cumulative carcinogenic risk-based level is less than 1×10^{-4} and for noncarcinogens until the cumulative hazard index is less than 1. Institutional controls shall include access restrictions and warning signs.

Remedial Action Work Plans for ISB and MNA were completed during FY 2003 to govern the operations, monitoring, and analysis strategy that will be used to measure progress toward meeting the first RAO. During FY 2003, NPTF operations were monitored to ensure that the reinjected effluent met the second RAO. Engineering and administrative controls to prevent the use of contaminated groundwater until the third RAO is met were also implemented during FY 2003. These institutional controls included visible access restrictions, control of activities, prevention of well drilling (except as required to support remedial action), and control of land use.

2.2 Component Descriptions

Figure 1 provides a conceptual illustration of the multiple components of the remedy. Figure 2 gives a more detailed overview of the TCE plume and the associated zones (hot spot, medial, and distal). The wells in and surrounding the contamination plume also are shown. The following sections describe each component and the specific objectives and requirements for this reporting period (FY 2003). The three remedy components associated with their respective zone are ISB for the hot spot, a New Pump and Treat Facility for the medial zone, and MNA for the distal zone of the TCE plume.

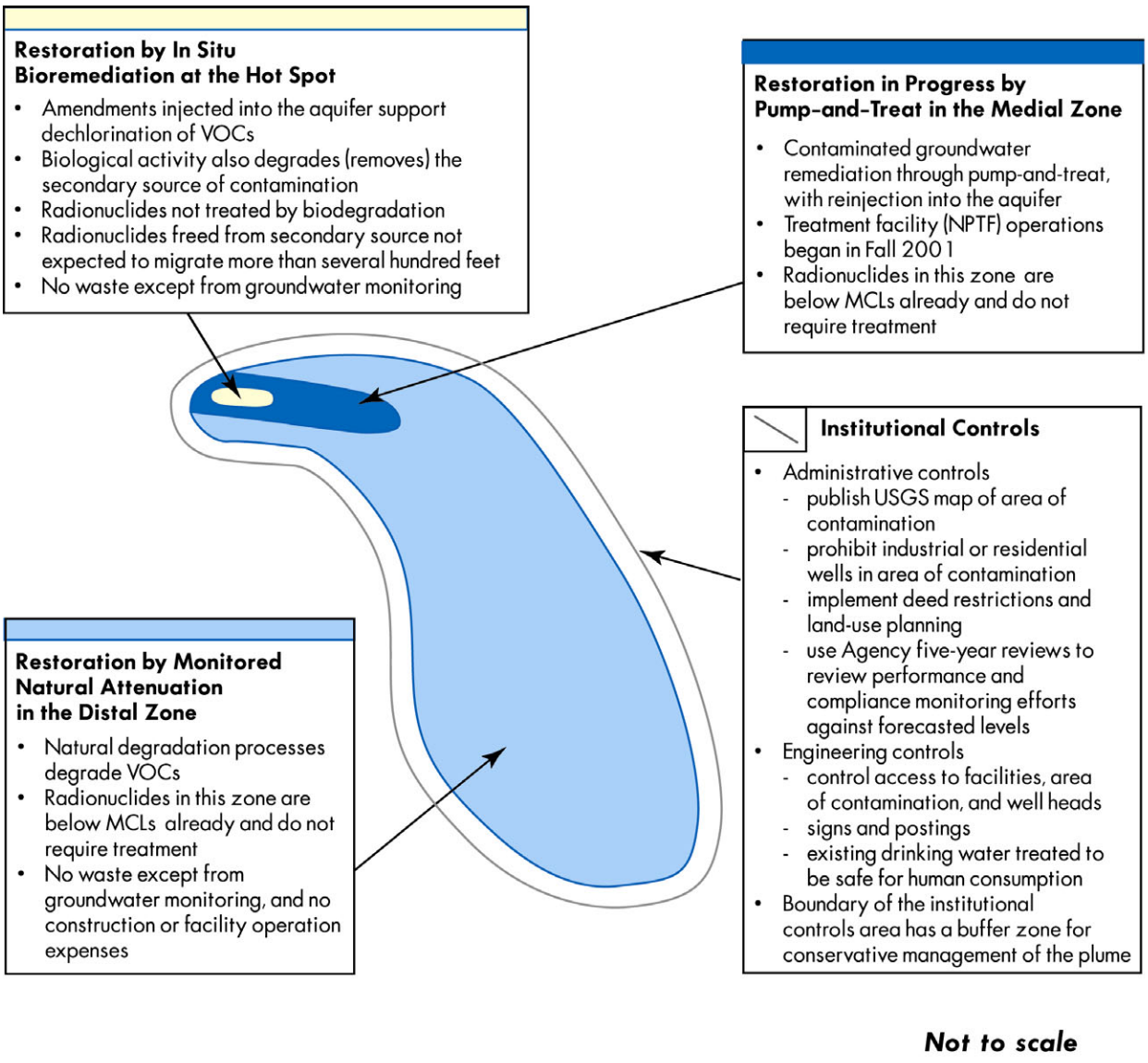


Figure 1. Conceptual illustration of the components of the remedy.

2.2.1 In Situ Bioremediation

The ISB activities began in November 1998 with an initial field evaluation to determine whether anaerobic reductive dechlorination (ARD) of TCE could be implemented as the preferred remedy for the hot spot portion of the TCE plume (Figure 2). Upon successful demonstration, ISB was officially selected as the remedy for the hot spot, the highly contaminated area in the immediate vicinity of the TSF-05 injection well. Subsequent activities have focused on optimization of the ISB process. The ISB operational timeframe for future activities consists of a phased implementation strategy. The ISB phases consist of interim operations, initial operations, optimization operations, and long-term operations. The planned timeframe and phase descriptions encompassing this report are described in Table 2.

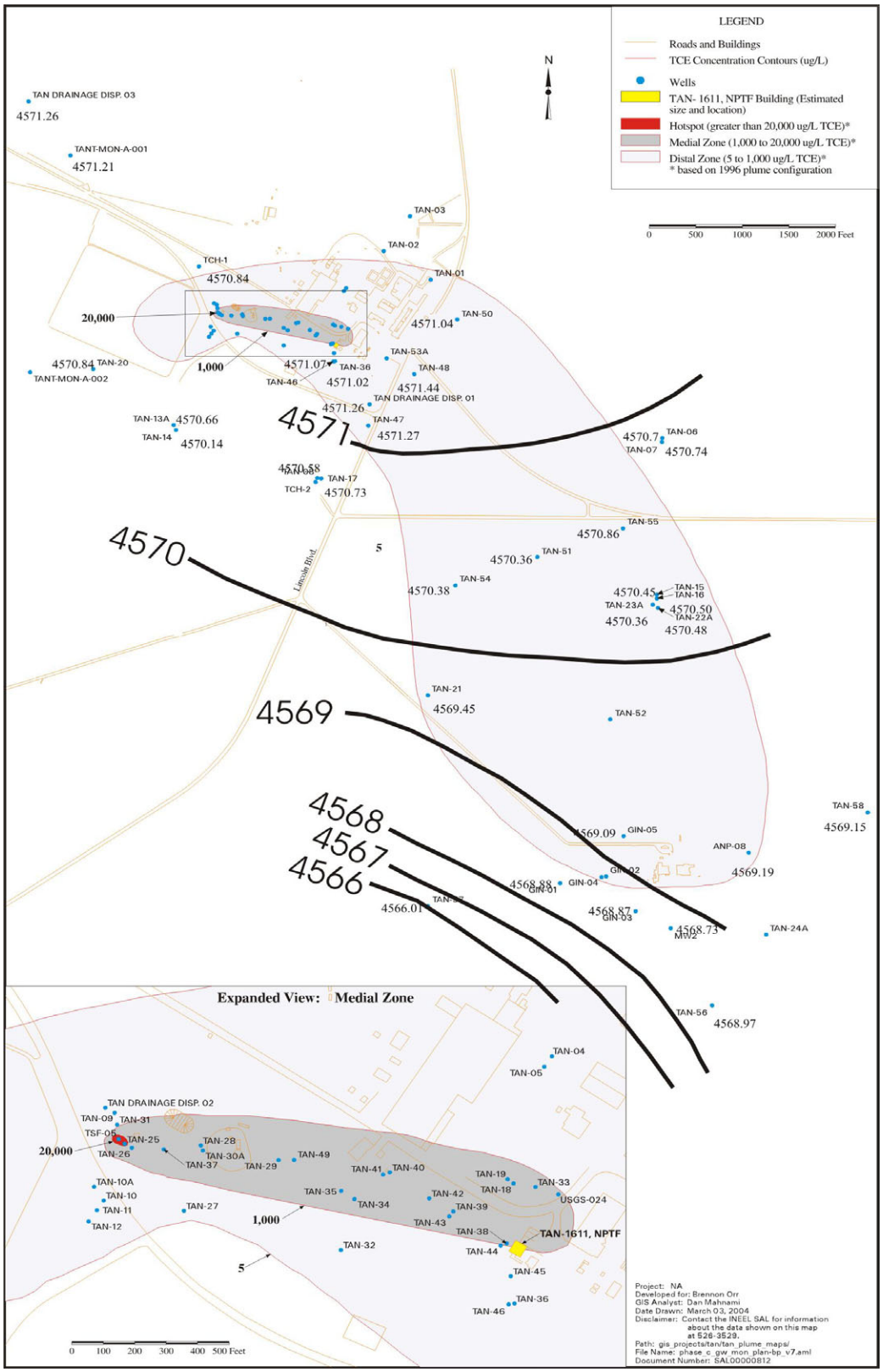


Figure 2. Trichloroethene plume and the associated zones based on preremedial action concentrations.

Table 2. In situ bioremediation operational timeframe.

Implementation Phases	Planned Timeframe	Phase Description
Predesign operations	May 2001–October 2002	Operate the ISB system to contain and degrade the ISB hot spot; determine whether sodium lactate injection results in mobilization of metals, strontium, and/or semivolatile organic compounds from the secondary source; determine how to better distribute electron donor within the upper part of the aquifer; and provide data/information to support a full-scale ISB system design.
Interim operations	November 2002–October 2003	Continue predesign operation activities and implement additional activities that support a better understanding of alternate electron donors, development of injection strategies that support the initial operations phase, ISB model refinement, continued ISB lactate addition, and continued operations during design and construction of the full-scale ISB system. (Details are listed in Table 3.)
Initial operations	November 2003–September 2005 (estimated)	Focus activities on reducing the flux of VOCs from the hot spot in the downgradient direction, as measured at TAN-28 and TAN-30A; implement field activities to support a better understanding of an alternate electron donor; and gather and analyze data relating to achievement of long-term performance objectives.
Optimization operations	October 2005–September 2011 (estimated)	Focus activities on reducing the flux of VOCs from the hot spot in the crossgradient direction, as measured at TAN-1860 and TAN-1861, while maintaining VOC flux reduction in the downgradient direction, and gather and analyze data relating to achievement of long-term performance objectives.
Long-term operations	October 3, 2011–TBD	Focus on achievement of hot spot source degradation while maintaining the reduction of VOC flux from the hot spot in the crossgradient and downgradient directions, and gather and analyze data relating to achievement of long-term performance objectives.

ISB = in situ bioremediation
TAN = Test Area North
TBD = to be determined
VOC = volatile organic compound

The majority (11 months) of FY 2003 activities were conducted as part of interim operations. Interim operations were implemented from November 2002 through October 2003. They began upon the approval of the Remedial Action Work Plan and ended with the completion of construction of the new ISB Injection Facility, which marked the start of initial operations in November 2003. The interim operations phase was essentially a continuation of the predesign operation objectives and included activities designed to support a better understanding of alternate electron donors (AEDs), development of injection strategies to support the initial operations phase, ISB model refinement, and continued ISB sodium lactate addition. The *In Situ Bioremediation Operations and Maintenance Plan for Test Area North, Operable Unit 1-07B* (DOE-ID 2004a) and *In Situ Bioremediation Remedial Action Groundwater Monitoring Plan for Test Area North, Operable Unit 1-07B* (INEEL 2003a) governed the interim operations. The specific objectives for FY 2003 ISB activities are summarized in Table 3. Descriptions and results of ISB activities for FY 2003 are presented in the *Annual Performance Report for In Situ Bioremediation Operations November 2002 to October 2003, Test Area North, Operable Unit 1-07B* (Armstrong et al. 2004).

Table 3. Objectives and activities for the interim operations phase during Fiscal Year 2003.

Objective	Activities (see Section 3.1)
A. Continue to meet predesign objectives.	• Continued ISB system operation (sodium lactate injection and groundwater monitoring), sampling, and analysis.
B. Determine the effectiveness of AEDs relative to lactate for sustaining ARD reactions within the aquifer (defined in the *Enhanced In Situ Bioremediation Field Evaluation Work Plan, Test Area North, Operable Unit 1-07B* [DOE-ID 1998], Appendix E, for PDP-III).	• Conducted laboratory studies evaluating various AEDs.
C. Determine how to better distribute electron donor within the upper part of the aquifer (defined in DOE-ID 1998, Appendix E, for PDP-III) in order to determine the ISB initial operations configuration.	• Optimized electron donor injection volume, concentration, and frequency. Injections were modified between 4X 3%[a] and 1X 6%.[b] • Verified effectiveness of injection strategy using groundwater monitoring data from 17 monitoring locations.
D. Refine the ISB numerical model so it may be used to support ISB design assumptions.	• No substantial model development was performed. Two well-injection strategies were simulated to support future injection scenarios.
E. Continued operation and maintenance of current ISB system	• Continued ISB system operation (sodium lactate injection and groundwater monitoring), sampling, and analysis. • Construction, component testing, system operability test, and final inspection of the new ISB facility. • Three new wells were installed. The TAN-1859 well was installed as a new nutrient injection well. The TAN-1860 and TAN-1861 wells were installed as monitoring wells on a transect perpendicular to flow from the hot spot.

a. 4X 3% = an injection volume of approximately 48,000 gal and a 3% concentration of sodium lactate.
b. 1X 6% = an injection volume of approximately 12,000 gal and a 6% concentration of sodium lactate.
AED = alternate electron donor
ARD = anaerobic reductive dechlorination
DOE-ID = U.S. Department of Energy Idaho Operations Office
ISB = in situ bioremediation
TAN = Test Area North

2.2.2 New Pump and Treat Facility

Pump-and-treat is being implemented for restoration of the medial zone (Figure 2). The NPTF is operated to capture contaminated groundwater across the width of the medial zone portion of the TCE plume. The major components of the pump-and-treat system include a network of extraction wells (TAN-38, TAN-39, and TAN-40), an aboveground treatment system that uses two air strippers to reduce concentrations of VOCs to less than MCLs, and a reinjection well (TAN-53A) that is used for injecting

treated water back into the aquifer. On October 1, 2001, routine operations of the NPTF began (ICP 2004a).

The FY 2003 operational objectives for the NPTF are summarized in Table 4. These objectives and activities are discussed in more detail in the *New Pump and Treat Facility Annual Operations Report, October 2002 through September 2003, Test Area North Final Groundwater Remedy, Operable Unit 1-07B* (ICP 2004a).

Table 4. New Pump and Treat Facility operation requirements for Fiscal Year 2003 operations.

Category	Objectives	Activities (see Section 3.2)
Operations	Operational uptime greater than 90%	Operational uptime of 98% for NPTF
	Extraction flow rate between 120 to 250 gpm	Flow rates were between required limits, except for brief shutdown periods.
Influent, effluent, and air emissions monitoring	The VOC and radionuclide concentrations in water discharged from the NPTF must be below MCLs and a 1×10^{-5} total risk-based level.	Effluent concentrations below MCLs and total risk-based level
	Air emissions from the NPTF must be maintained below 0.18 lb/hr for TCE, 4.9 lb/hr for PCE, 564.3 lb/hr for cis-DCE, and 0.33 lb/hr for vinyl chloride.	Air emissions within regulatory requirements
	Completeness goal of 100% for NPTF influent sampling	NPTF influent sampling completeness of 100%
Plume capture	Verify plume capture using pumping and drawdown tests.	Water levels in TAN-19, TAN-32, TAN-33, and TAN-36 indicate that the minimum required capture zone width has been achieved.
Upgradient source control	Monitor the upgradient groundwater to provide sufficient warning so that operational changes can be made if groundwater with higher than anticipated contaminant concentrations is moving toward the extraction wells.	Concentrations of COCs in TAN-29 were used as an indicator. No evidence that water with substantially higher contaminant concentrations than previously treated is moving toward the NPTF extraction wells.
Baseline performance monitoring	Evaluate the effects of operating the NPTF on groundwater quality in selected wells near the NPTF, and monitor NPTF vicinity wells.	Completeness goal of 90% for performance sampling met

COC = contaminant of concern
DCE = dichloroethene
MCL = maximum contaminant level
NPTF = New Pump and Treat Facility
PCE = tetrachloroethene
TAN = Test Area North
TCE = trichloroethene
VOC = volatile organic compound

2.2.3 Monitored Natural Attenuation

Monitored natural attenuation is being implemented for restoration of the distal zone (Figure 2). Groundwater monitoring over the past decade has shown little or no increase in TCE concentrations downgradient from TSF-05. These observations suggested that a mechanism other than dispersion was operational in the aerobic distal zone of the TCE plume. Through a series of site investigations, scientific studies, and regulatory activities, MNA was evaluated and selected as the remedy for the distal zone of the groundwater plume contaminated at levels below 1,000 μg/L TCE (DOE-ID 2001b).

Groundwater sampling was conducted during FY 2003 in accordance with the *Monitored Natural Attenuation Operations, Monitoring, and Maintenance Plan for Test Area North, Operable Unit 1-07B* (DOE-ID 2003a), which specified the wells to be sampled and parameters for analysis to support the continued evaluation of MNA performance. Specific objectives for groundwater monitoring are established in the *Monitored Natural Attenuation Remedial Action Work Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B* (DOE-ID 2003b). The remedial objectives defined in the MNA Remedial Action Work Plan (DOE-ID 2003b) are described below:

Compliance objectives:

- Conduct groundwater monitoring at all MNA performance-monitoring wells at a frequency and duration sufficient to demonstrate that the remedy is operational, functional, and effective
- Demonstrate at the end of the remedial action period that RAOs for groundwater have been attained.

Performance objectives:

- Monitor whether the natural attenuation process continues to trend toward the RAOs for the distal zone of the plume
- Monitor plume expansion.

The MNA operational timeframe for future activities consists of a phased implementation strategy. The planned timeframe and phase descriptions are shown in Table 5.

2.3 Component Integration

The OU 1-07B remedy is unique in that multiple technologies were brought to bear on a single contaminated groundwater plume. In situ bioremediation was applied to quickly reduce contaminant concentrations in the source area, the NPTF was initiated to minimize downgradient transport of contaminated water, and MNA is expected to provide an efficient and cost-effective technique to bring residual contamination to below regulatory levels within the duration of the remedial action period. Each component controls the flux of contamination into the next remediation zone, resulting in overall reduction of the plume concentrations and establishment of trends toward RAOs. As illustrated in Figure 3, as the contaminant levels are reduced over time, the active remedial components (ISB and NPTF) will be phased out. Upon completion of ISB and NPTF operations, MNA will continue throughout the plume to meet the RAOs by 2095.

The design of each remedial action component was evaluated and, for each monitoring zone, the monitoring types, sample parameters, decision/evaluation objective, goals, sample programs, and requirements basis were identified for the duration of the remedy. Table 6 provides a crosswalk of the requirements and activities for each of the three monitoring zones.

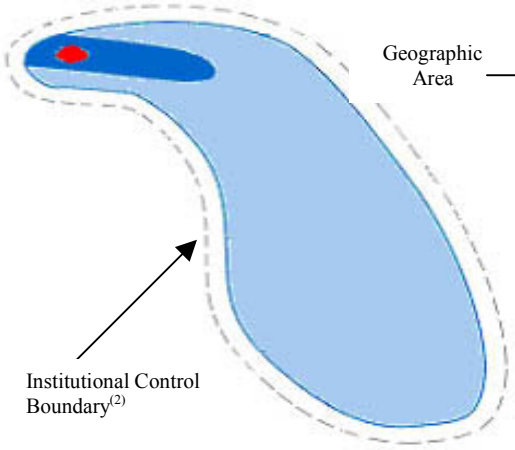
Table 5. Monitored natural attenuation operational timeframe.

Implementation Phases	Planned Timeframe	Phase Description
Performance operations	2003–2013	• Annual sampling and analysis to confirm that TCE is being transported and degraded as expected • Periodic water level measurements to monitor the flow field • Well maintenance activities to ensure the monitoring well network remains functional • Actual duration of the performance phase may be adjusted by the Agencies based on results.
Long-term operations	2014–2095	• Periodic groundwater monitoring to track the remedy's progress toward achieving the RAOs • Periodic water level measurements to monitor the flow field • Well maintenance activities to ensure the monitoring well network remains functional.

RAO = remedial action objective
TCE = trichloroethene

2001–2015[1]

Operations during this period consist of ISB at the hot spot, NPTF at the medial zone, and MNA in the distal zone. It is assumed that ISB has successfully achieved the completion criteria for performance operations, which consist of stopping VOC flux from the hot spot.



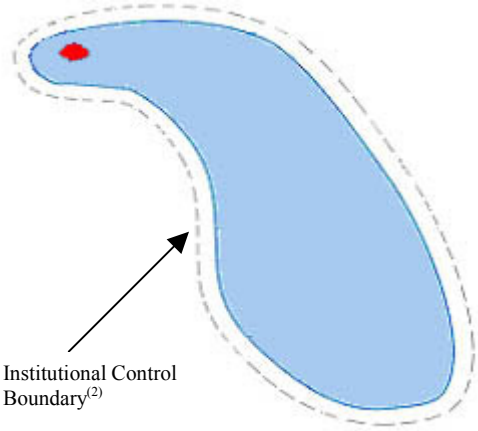
Geographic Area →

Monitoring Program

Hot Spot	Medial Zone	Distal Zone	Remedy Component
ISB Performance ISB Compliance NPTF Performance (NPTF Contingency)	NPTF Performance NPTF Compliance		ISB NPTF
MNA[3] Performance (Radionuclide)	N/A	MNA [3] Performance	MNA

2016–2020[1]

Operations during this period consist of ISB at the hot spot and MNA for the distal zone[4]. It is assumed that the NPTF has successfully achieved the medial zone completion criteria and is in standby mode.



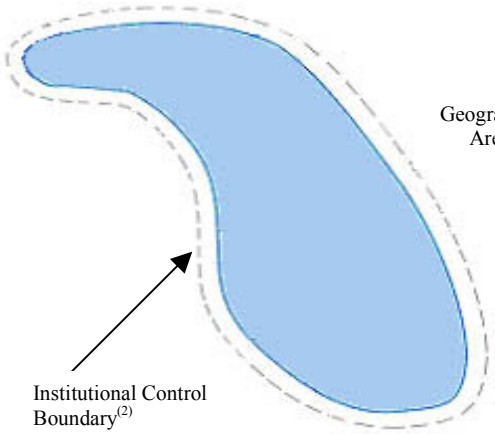
Geographic Area →

Monitoring Program

Hot Spot	Medial Zone	Distal Zone	Remedy Component
ISB Performance ISB Compliance N/A	N/A		ISB NPTF
MNA Performance (Radionuclide)	MNA Performance[5]	MNA Performance	MNA

2021–2095[1][6]

Operations during this period consist of MNA in the distal zone[4]. It is assumed for this period that ISB has successfully achieved the completion criteria for long-term operations and not only has the flux been cut off, but the source has been degraded.



Geographic Area →

Monitoring Program

Hot Spot[7]	Medial Zone	Distal Zone	Remedy Component
MNA Performance[5] (Radionuclide)	MNA Performance[5]	MNA Performance	ISB NPTF MNA

1. The dates and the shape of the plume shown are for illustrative purposes only.
2. The institutional control boundary extends 40% beyond the current dimensions of the plume; expansion accounts for 30% and a buffer zone accounts for 10%. 30% plume expansion is allowed in the ROD (DOE-ID, 2001b).
3. The MNA compliance requirements during this period consist of annual monitoring for at least the first 5 years.
4. The distal zone is defined as the areal extent of the plume that is less than 1,000 µg/L TCE and greater than 5 µg/L TCE.
5. The MNA monitoring program will be expanded to include additional wells to be monitored for MNA performance parameters.
6. Assumes the hot spot has been removed.
7. In situ bioremediation or some yet-to-be-determined technology will operate at the hot spot until hot spot RAOs are achieved.

Figure 3. Generalized monitoring program operations throughout the remedy timeframe.

Table 6. Monitoring crosswalk table for the Operable Unit 1-07B groundwater-remediation remedy.

Monitoring Zone	Monitoring Type	Sample Parameter	Decision/Evaluation Objective	Goal	Sample Program	Basis Document
Hot spot	ISB performance	ISB performance parameters: • VOCs • Tritium • Ethene, ethane, methane, redox-sensitive parameters, electron donor, bioactivity, and nutrient.	Trending: • Donor distribution • Source degradation • Flux • Alternate donor.	Optimize operation to meet compliance objectives/requirements.	ISB	ISB Work Plan
	ISB compliance	VOCs (TAN-28 and TAN-30A)	VOCs below MCLs for 1 year	Achieve reduction of downgradient flux to below MCLs.	ISB	ISB Work Plan
		VOCs (TAN-1860 and TAN-1861)	VOCs below MCLs for 1 year	Achieve reduction of crossgradient flux to below MCLs.		
	ISB completion compliance	All VOCs (wells TBD)	Hot spot completion	Determine whether ISB RAOs have been met in the hot spot.	ISB	ISB Remedial Action Report
	NPTF performance	VOCs plus radionuclides (strontium, cesium); TAN-29	Upgradient source	NPTF contingency evaluation monitoring	NPTF	NPTF Work Plan
	MNA performance	Radionuclides (strontium and cesium; TAN-25, TAN-37, TAN-28, TAN-30A, TAN-29, and TSF-05)	Upgradient radionuclide monitoring (hot spot)	Monitor/evaluate hot spot radionuclide degradation and migration.	MNA	MNA Work Plan

Table 6. (continued).

Monitoring Zone	Monitoring Type	Sample Parameter	Decision/Evaluation Objective	Goal	Sample Program	Basis Document
Medial zone	NPTF performance	Draw down	Facility operations	Plume capture	NPTF	NPTF Work Plan
	NPTF compliance	Facility influent/effluent VOCs and strontium	Facility operations	Stay within influent and effluent specifications.	NPTF	NPTF Work Plan
	NPTF completion compliance	Air emissions	Facility operations	Stay within effluent specifications.		
		Operations uptime	Facility operations	Maintain 90% uptime.		
		Extraction flow rate	Facility operations	Operate within specified flow rate.		NPTF Work Plan
		All COCs (wells TBD)	Medial zone completion	Determine that NPTF RAOs have been or can be met in the medial zone.	NPTF	
Distal zone	MNA performance	MNA performance parameters: • TCE • DCE • PCE • Vinyl choride • Tritium.	Breakthrough curves	Trends are toward achievement of RAOs.	MNA	MNA Work Plan
	MNA compliance	MNA performance parameters for 5 years	Plume expansion			
			Degradation rate	Annual sampling is a requirement for at least the first 5 years.	MNA	MNA Work Plan
	MNA completion compliance	All COCs	MNA performance parameters	Determine that RAOs have been met throughout the plume.	MNA	MNA Remedial Action Report
			Remedial action completion			

Table 6. (continued).

Monitoring Zone	Monitoring Type	Sample Parameter	Decision/Evaluation Objective	Goal	Sample Program	Basis Document

COC = contaminant of concern
DCE = dichloroethene
DOE-ID = U.S. Department of Energy Idaho Operations Office
ISB = in situ bioremediation
MCL = maximum contaminant level
MNA = monitored natural attenuation
NPTF = New Pump and Treat Facility
PCE = tetrachloroethene
RAO = remedial action objective
TAN = Test Area North
TBD = to be determined
TCE = trichloroethene
TSF = Technical Support Facility
VOC = volatile organic compound

3. 2003 REMEDY PERFORMANCE

The three components of the final groundwater remedy are currently in operation. The NPTF went online at the start of FY 2002. During FY 2003, ISB and MNA began interim operations during FY 2003. This section summarizes the technical performance for each component. Overall, initial performance data are consistent with expectations. Detailed information is available in the FY 2003 annual report for each component.

3.1 In Situ Bioremediation

The ISB interim operational objectives (listed in Section 2, Table 3) were successfully met during FY 2003. Activities performed to meet the objectives were reported in the *Annual Performance Report for In Situ Bioremediation Operations November 2002 to October 2003, Test Area North, Operable Unit 1-07B* (Armstrong et al. 2004).

3.1.1 Operations

A summary of FY 2003 ISB activities, and an indication of which objective(s) was addressed (see Table 3), is provided below.

- Five 4X 3% sodium lactate injections (an injection volume of approximately 48,000 gal and a 3% concentration of sodium lactate) and two 1X 6% sodium lactate injections (an injection volume of approximately 12,000 gal and a 6% concentration of sodium lactate) were performed. These injections were made in an effort to experiment with different electron donor injection strategies in order to improve ARD efficiency while avoiding density differences that would cause the injected sodium lactate solution to sink to the base of the aquifer before being utilized (Objectives A, C, and E).

- Three wells were installed during this reporting period. The TAN-1859 well was drilled to 302 ft below land surface (bls) and installed as a new nutrient injection well to be connected to the ISB Injection Facility. The TAN-1860 well (drilled to 413 ft bls) and the TAN-1861 well (drilled to 414 ft bls) were installed as monitoring wells. Both monitoring wells were drilled to the top of the Q-R interbed. Work on this drilling project began in May 2003 and was completed in September 2003. Details of the well construction are provided in the *Well Completion Report Test Area North, Well Construction 2003 Operable Unit 1-07B* (INEEL 2004) (Objectives C and E).

- During this reporting period, workers constructed the new ISB facility. This facility is approximately 1,500 ft^2 and is designed to house the amendment injection system and to provide office and laboratory space for rapid turnaround field testing. After ISB construction was complete, component testing was performed on the injection system to ensure that the equipment was properly installed and operated in accordance with the design specifications. The component testing was followed by a system operability test using potable water to demonstrate proper operation of the total treatment system. Concurrent with the system operability test, a management self-assessment of the facility was used to determine the facility's operational readiness, including a review of procedures, training, and other items necessary to safely operate the system. Afterward, the Agencies conducted a final inspection, which concluded that the facility was ready to begin operations. The *In Situ Bioremediation Final Inspection Report* (ICP 2004b) provides a summary of the final inspection, findings, and corrective actions for the facility (Objective E).

- Laboratory studies of AEDs were designed to assess the beneficial properties of AEDs (relative to sodium lactate) for achieving cost-effective dechlorination in the TSF-05 source area. The criteria determined to be important in this system were ARD efficiency and cost-effectiveness, impact of AED solution on contaminant solubility, impact of the AED on the microbial community, and the metals content of the AED injection solution. Studies were performed to address each of these four criteria. Complete descriptions of the molecular studies—including the methods, results, and conclusions—are presented in the *Fiscal Year 2003 Alternate Electron Donor Evaluation, Test Area North Final Remedy, Operable Unit 1-07B* (Wood et al. 2004) (Objectives A and B).

- Monthly monitoring of 14 wells (17 total monitoring locations), with an average of 93.5% completion (Objectives A and E), was conducted.

3.1.2 Optimization Studies

The following information pertains to the optimization studies:

- Groundwater modeling was used to support the ISB remedy component. During previous reporting periods, investigators developed a predictive tool that can be used to simulate electron donor transport and distribution under various electron donor injection strategies. No substantial model development work was performed during the reporting period (Objectives B and E).

- Concentrations of trans-DCE have remained relatively steady in the source area wells since the beginning of ISB operations. Because of this, it was recommended in the *Annual Performance Report for In Situ Bioremediation Operations August 2001 to October 2002, Test Area North Operable Unit 1-07B* (INEEL 2003b) that the rate of ARD of trans-DCE relative to cis-DCE be evaluated in laboratory microcosm studies. Therefore, in 2003, a laboratory test was established to compare observed dechlorination rates of trans-DCE, cis-DCE, and TCE (Objectives B and E).

3.2 New Pump and Treat Facility

Details for the FY 2003 NPTF activities were reported in the *New Pump and Treat Facility Annual Operations Report, October 2002 through September 2003, Test Area North Final Groundwater Remedy, Operable Unit 1-07B* (ICP 2004a). Operational details from the annual report are summarized below.

3.2.1 Operations

The following information pertains to operations:

- The NPTF operated within the required limits throughout FY 2003. These limits include operational uptime (met with 98% uptime) and extraction well flow rate (reported between required limits, except for brief shutdown periods).

- Purge water processed by the NPTF during FY 2003 was handled in accordance with procedures.

- Routine inspections were performed as required.

- There were 12 planned and 2 unplanned outages between October 2002 and September 2003. Unplanned shutdowns resulted from a faulty well transducer and a spurious high-level alarm in the air stripper 311 sump. Recovery from the unplanned shutdowns was accomplished by replacing the faulty transducer and resetting the system. No other corrective maintenance was performed during this period. Planned shutdowns occurred in order to maintain software, replace reinjection piping, complete drawdown tests, and conduct annual facility testing.

- The 90% completeness goal for performance sample collection and analysis was met. The 100% completeness goal for compliance sample collection was met.

3.2.2 Influent, Effluent, and Air Emissions Monitoring

The following information pertains to influent, effluent, and air emissions monitoring:

- The COC concentrations in NPTF influent declined during FY 2003 and are now approximately 10% of the design concentrations.

- Effluent concentrations of COCs, including both VOCs and radionuclides, were below MCLs throughout FY 2003. The cumulative carcinogenic risk due to VOCs that are COCs was less than the 1×10^{-5} requirement throughout the fiscal year.

- Two independent calculations of VOC mass discharge concluded that the mass flow rates of each VOC discharged from the NPTF air strippers to the atmosphere were within regulatory requirements.

3.2.3 Plume Capture

The hydraulic response of four wells near the edge of the capture zone (TAN-19, TAN-32, TAN-33, and TAN-36) was monitored. Drawdown in these wells indicates that the minimum required capture zone width has been achieved.

3.2.4 Upgradient Source Control

The following information pertains to upgradient source control:

- Concentrations of COCs in TAN-29 were used as an indicator of temporal trends in water approaching the extraction wells.

- Concentrations of VOCs in the TAN-29 well showed an increasing trend during FY 2003. This increasing concentration likely is a result of rebound after pumping stopped at TAN-29 in December 2000. However, VOC concentrations are still less than historical levels at TAN-29, and the water moving into the NPTF treatment zone has VOC concentrations well below the design basis.

- The concentration of strontium-90 remained relatively constant during the reporting period.

- There is no evidence that a body of water that has substantially higher contaminant concentrations than has been previously treated is moving toward the NPTF extraction wells. Hence, NPTF effluent limits will not be exceeded and no changes in NPTF operations are needed.

3.2.5 Baseline Facility Performance

The following information pertains to baseline facility performance:

- Concentrations of COCs were monitored quarterly in the TAN-29, TAN-33, TAN-36, TAN-43, and TAN-44 wells

- The 90% completeness goal was met for all analytes.

3.3 Monitored Natural Attenuation

Sampling during FY 2003 was governed by the *Monitored Natural Attenuation Operations, Monitoring, and Maintenance Plan for Test Area North, Operable Unit 1-07B* (DOE-ID 2003a), which supports the objectives stated in the *Monitored Natural Attenuation Remedial Action Work Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B* (DOE-ID 2003b). The MNA Operations, Monitoring, and Maintenance Plan (DOE-ID 2003a) specifies the sampling locations, sampling frequencies, analytical methods, reporting requirements, sampling procedures, quality assurance/quality control requirements, and data validation requirements. Data analyses also were conducted and the results of these analyses, as well as results of groundwater monitoring work, are summarized below.

The FY 2003 activities are presented in the *Monitored Natural Attenuation 2003 Performance and Compliance Monitoring Annual Report for Test Area North Operable Unit 1-07B* (DOE-ID 2004b). Results of groundwater monitoring data are presented, summarized, evaluated, and interpreted with historical data. In addition, TAN well maintenance activities are included to report on the integrity of the monitoring well network and provide additional information that may be necessary for analytical data interpretation.

3.3.1 Groundwater Monitoring

The following activities pertain to groundwater monitoring:

- Samples were collected and analyzed for COCs from a monitoring well network of 17 wells that includes three zones. Zone 1 performance-monitoring wells include TAN-16, TAN-51, TAN-54, and TAN-55 for VOC contaminants and tritium, and TAN-25, TAN-28, TAN-29, TAN-30A, TAN-37, and TSF-05 for radionuclide contaminants. Zone 2 performance monitoring wells include TAN-21, TAN-52, and ANP-8 for VOC contaminants and tritium. Zone 3 monitoring wells include TAN-56, TAN-57, TAN-58, and GIN-4. Monitoring in Zone 3 is performed to verify that the plume does not expand axially more than 30% beyond the downgradient extent of the 5-μg/L isopleth.

- Indirect and direct evidence from FY 2003 groundwater monitoring confirms the conclusions that the mechanism for aerobic TCE degradation is active in the aquifer. This included observations of the enzyme substrate methane and direct detection of cometabolically active enzymes using activity-dependent enzyme probes.

- The data from FY 2003 indicate that the remedy continues to trend toward achievement of RAOs.

- Radionuclide groundwater monitoring in FY 2003 indicates that the natural attenuation mechanisms—as defined in the MNA Remedial Action Work Plan (DOE-ID 2003b) for the radionuclides tritium, cesium-137, strontium-90, and uranium-234—continue to be functional within the contaminant plume (DOE-ID 2003b). All observed tritium concentrations were below the MCL and are decreasing. Cesium-137 is present in the residual source area, but it was not detected outside of the residual source area. Uranium-234 is below MCLs in all wells. Strontium-90 concentrations show a reduction with increasing distance from the source area.

3.3.2 Data Analyses

The following information pertains to data analyses:

- The period of time in which peak breakthrough will occur has been predicted in each Zone 1 well included in the MNA monitoring program using the numerical model. Predictions were made for each well using the estimated TCE degradation half-life of 13.2 years (DOE-ID 2003b; INEEL 2003c). The current data for TAN-16 appear to demonstrate a concentration peak followed by a decline. In other monitoring wells, sufficient data have not been collected to determine whether breakthrough has occurred. Confirmation of peak breakthrough in all MNA wells will be demonstrated with continued groundwater monitoring. According to model predictions, peak breakthrough in FLUTe™ wells (TAN-51, TAN-54, and TAN-55) occurred before 2001. Data are insufficient to evaluate peak breakthrough in these wells because groundwater monitoring in these wells began after the peak breakthrough period; monitoring began in 2001 for TAN-51 and 2002 for the other wells. Peak breakthrough is expected to occur in TAN-16 sometime between 2004 and 2006. Future groundwater monitoring will be used to confirm a declining trend in TCE concentration that would be expected after the occurrence of peak breakthrough.

- According to model predictions, peak breakthrough in Zone 2 wells (TAN-21, TAN-52, and ANP-8) will occur in the future. Statistical analyses of TCE concentrations will be used to analyze the breakthrough and declining trend at these wells.

- The FY 2003 groundwater monitoring data from Zone 3 wells (GIN-4, TAN-56, TAN-57, and TAN-58) indicate that the plume has not expanded. Future monitoring, as outlined in the MNA Operations, Monitoring, and Maintenance Plan (DOE-ID 2003a), will be adequate to continue tracking progress of the MNA remedy for VOCs at TAN OU-1-07B (DOE-ID 2003a).

- The numerical model has been updated using the most recent TCE half-life estimate (INEEL 2003c). The FY 2003 groundwater monitoring data and subsequent evaluation presented confirmed again that the TCE degradation mechanisms are present and active and that the TCE half-life estimate and numerical model are appropriate tools for evaluating the progress of MNA.

- A comparison of observed concentrations to numerical model predicted concentrations has demonstrated, as noted in the MNA Remedial Action Work Plan (DOE-ID 2003b), that the numerical model does not accurately predict the magnitude of TCE concentrations but remains useful to predict peak breakthrough times. As peak breakthrough is confirmed during the predicted times and continued concentration decrease is observed following the peak breakthrough, the progress of the remedy in meeting the RAOs (as predicted by the model) will be confirmed (DOE-ID 2003b).

3.4 2003 Combined Remedy Performance

Based on the results of FY 2003 remedial activities, the combined OU 1-07B remedy appears to be effective. Even though the three components are in early operational phases, they appear to be sufficiently integrated and initial performance trends are on track with the expected long-term trends.

The OU 1-07B remedy is unique in that multiple technologies were brought to bear on a single contaminated groundwater plume. In situ bioremediation was applied to reduce contaminant concentrations in the source area; the NPTF was initiated to remediate the contaminated groundwater in the medial zone; and MNA is expected to bring residual contamination to below regulatory levels within the duration of the remedial action period. Each component controls the flux of contamination into the next remediation zone, resulting in overall impacts to the plume concentrations. As illustrated in Figure 3,

as the contaminant levels are reduced over time, the active remedial components (ISB and NPTF) will be phased out. Upon completion of ISB and NPTF operations, the mechanism driving natural attenuation (aerobic degradation) will continue throughout the plume and continue the trend toward meeting the RAO by 2095.

3.4.1 In Situ Bioremediation Performance Summary

The ISB system continued to operate through the end of the interim operations phase, stimulating ARD throughout most of the source area. Ethene was present in significant concentrations in all the source area wells, indicating active ARD.

During this reporting period, two injection strategies were tested. The first, 4X 3%, resulted in increased radial distribution of electron donor and increased ARD at locations near the edge of the source. For example, TAN-D2 is now "clean" with all contaminants below MCLs. The VOC and redox data from TAN-D2 provide strong evidence that the residual source has been degraded near TAN-D2. However, the high volumes of potable water associated with the 4X 3% injections are thought to have reduced ARD efficiency, particularly in areas nearest the injection point. In July 2003, the injections were changed back to 1X 6%, which appear to be restoring efficiencies in the source area as TCE and cis-DCE concentrations are trending downward in the source area wells.

The ISB Injection Facility also was completed during this reporting period, allowing injection into multiple wells as needed. Three new wells were also installed during this time (TAN-1859, TAN-1860, and TAN-1861). The TAN-1859 well was completed within the residual source area, while TAN-1860 and TAN-1861 were completed outside of the residual source area. It is anticipated that TAN-1859 will initially be used as an injection well. All three wells provide additional monitoring locations near the downgradient edge of the source area. The completion of these activities allows the project to conclude interim operations and proceed into initial operations in accordance with the *In Situ Bioremediation Remedial Action Work Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B* (DOE-ID 2004c).

3.4.2 New Pump and Treat Facility Performance Summary

During FY 2003, compliance monitoring included collecting samples from the NPTF influent sampling port, SP-1. All VOC and tritium concentrations entering the NPTF through SP-1 decreased during FY 2003. The concentration ranges from October 2002 through September 2003, including peak highs and lows, are shown in Table 7. Concentrations of VOCs and tritium in NPTF influent samples generally showed an overall trend of declining concentrations with a large amount of scatter about this general trend. In contrast, strontium concentrations did not have an obvious trend but were varied. Gross alpha and gross beta measured in the NPTF influent did not exhibit a discernable trend but merely variation about a stable concentration. Throughout the fiscal year, Sr-90 was only detected above the detection limit in September 2003 (with a concentration of 0.516 pCi/L) and there was no discernible trend.

Table 7. New Pump and Treat Facility influent concentration trends at SP-1 through Fiscal Year 2003.

COC	Concentration in October 2001	Concentration in September 2002[a]	Concentration in September 2003[a]	FY 2003 Concentration Peak (month/year)	FY 2003 Concentration Low (month/year)
TCE (µg/L)	310	155	100	340 (October 2002)	100 (February 2003)
PCE (µg/L)	26	13	10	21 (November 2002)	9 (February 2003)
cis-DCE (µg/L)	36	8	5	24 (October 2002)	5 (September 2003)
trans-DCE (µg/L)	13	3	2	10 (October 2002)	2 (February and September 2003)
Tritium (pCi/L)	3,540	2,435	2,560	2,800 (October 2002)	1,960 (June 2003)

a. All concentrations are expressed as an average of duplicate values.
COC = contaminant of concern
DCE = dichloroethene
FY = fiscal year
PCE = tetrachloroethene
TCE = trichloroethene

The decrease in VOC concentrations may indicate that contaminant mass present in the medial zone has been substantially reduced by NPTF operations. From Table 7, it is evident that the influent TCE concentrations to the treatment unit (from the TAN-38, TAN-39, and TAN-40 extraction wells) are an order of magnitude lower than the original design basis. It is unclear how much of this effect is attributable to the influence of uncontaminated water from outside the plume being captured by the NPTF extraction wells or whether the ambient concentrations within the medial zone are actually that low. Figure 4 shows that the groundwater in the hot spot is effectively reduced to below 1,000 µg/L of TCE, so it is now analogous to the distal zone in terms of TCE contamination. Because of this fact, it may be beneficial to cease NPTF operation and determine if MNA is going to be effective throughout the plume. One way to accomplish this would be to conduct an NPTF rebound test to determine the actual medial zone concentrations. If TCE levels do rebound to some unacceptable level, then the NPTF could be restarted to again reduce medial zone concentrations.

3.4.3 Monitored Natural Attenuation Performance Summary

Water-chemistry data collected during FY 2003 MNA activities were analyzed in support of the evaluation and reporting activities of the MNA remedial action. These data collection and analytical activities document operational conditions prior to start of the MNA remedial action and support future interpretation of the monitoring data. The highlights of this activity are summarized below:

- The TCE concentration data and other data related to TCE degradation indicate that natural attenuation continues to trend toward meeting RAOs. The current data indicate that future groundwater monitoring will provide confirmation that peak breakthrough has occurred in TAN-51, TAN-55, and TAN-54 and that future groundwater monitoring will demonstrate peak breakthrough in TAN-16 and Zone 2 wells. The data also indicate that the plume has not significantly expanded.

- Groundwater monitoring of radionuclides during FY 2003 indicates that the natural attenuation mechanisms—as defined in Section 8 of the Record of Decision Amendment (DOE-ID 2001b) and the MNA Remedial Action Work Plan (DOE-ID 2003b) for the radionuclides tritium, cesium-137, strontium-90, and uranium-234—continue to be functional within the contaminant plume. No migration of strontium-90 or cesium-137 from the source area was observed. Tritium and uranium-234 were not detected above MCLs.

- Vertical profile sampling has been used to demonstrate that TCE degradation observations are not a result of a poor understanding of vertical contaminant distribution and that wells screened at intervals and those that can be sampled at discrete depths are useful for evaluating peak breakthrough.

- The numerical model has been updated using the most recent TCE half-life estimate (INEEL 2003c). A comparison of observed concentrations to numerical model predicted concentrations has demonstrated, as noted in the MNA Remedial Action Work Plan (DOE-ID 2003b), that the numerical model should only be used for predicting the time period during which peak breakthrough will occur.

- The potentiometric surface, calculated from FY 2003 water level data, confirmed the regional groundwater flow and continued water level decline.

- Groundwater monitoring for dissolved gases and enzyme probing of select samples has provided direct and indirect evidence of the presence of the TCE degradation mechanism at TAN. No further enzyme probe and dissolved gas sampling is required in order to document the degradation mechanism.

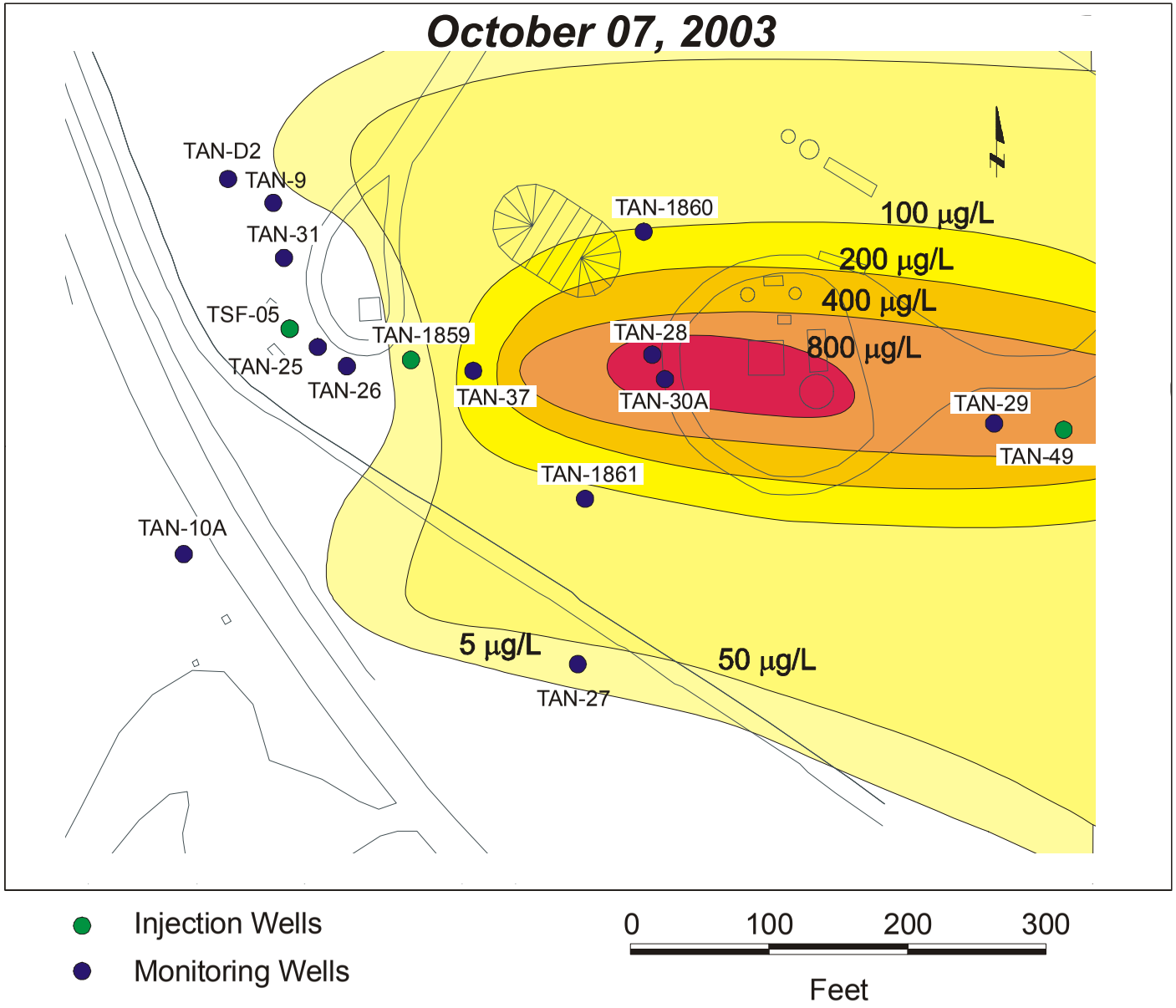


Figure 4. Trichloroethene isopleths.

4. 2003 PROJECT PERFORMANCE

The required scope, schedule, and budget for implementation of the OU 1-07B remedy is detailed in the Scope of Work (DOE-ID 2001a), Record of Decision Amendment (DOE-ID 2001b), and the ISB, NPTF, and MNA Remedial Design/Remedial Action Work Plans (DOE-ID 2004c, 2003c, and 2003b), respectively. Table 8 identifies FY 2003 required and completed activities for all three remedial action components. (No compliance monitoring was required for ISB during FY 2003.) Tables 9 and 10 list the required deliverables, enforceable submittal dates, and actual submittal dates for FY 2003 and FY 2004, respectively.

Table 8. Required activities during Fiscal Year 2003.

Requirement	Completed Activity
NPTF 120- to 250-gpm flow rate and 90% uptime	Operational uptime was 98%; extraction flow rate was maintained between the limits throughout the fiscal year, except during planned or unplanned shutdown periods.
NPTF compliance monitoring	Influent and effluent monitoring was performed in accordance with the *Sampling and Analysis Plan for the New Pump and Treat Facility Performance Monitoring Test Area North, Operable Unit 1-07B* (INEEL 2001).
Annual groundwater sampling	Groundwater sampling was performed in accordance with the *Monitored Natural Attenuation Operations, Monitoring, and Maintenance Plan for Test Area North, Operable Unit 1-07B* (DOE-ID 2003a).

DOE-ID = U.S. Department of Energy Idaho Operations Office
INEEL = Idaho National Engineering and Environmental Laboratory
NPTF = New Pump and Treat Facility

Table 9. Required deliverables during Fiscal Year 2003.

Deliverable	Enforceable Date	Actual Date
ISB Annual Performance Report	NA[a]	September 2003
NPTF Annual Performance Report	NA[a]	August 2003
MNA Annual Performance Report[b]	NA[a]	August 2003
NPTF Operation and Maintenance Plan (DOE-ID 2003d)	June 2003	January 2001
MNA Remedial Action Work Plan	March 2003	February 2003

a. No enforceable date; planned date was July 2003.
b. The FY 2003 deliverable was the *Fiscal Year 2002 Groundwater Monitoring Annual Report, Test Area North, Operable Unit 1-07B* (INEEL 2003d).
DOE-ID = U.S. Department of Energy Idaho Operations Office
FY = fiscal year
INEEL = Idaho National Engineering and Environmental Laboratory
ISB = in situ bioremediation
MNA = monitored natural attenuation
NA = not applicable
NPTF = New Pump and Treat Facility

Table 10. Required deliverables for Fiscal Year 2004.

Deliverable	Enforceable Date
ISB Annual Performance Report	NA[a]
NPTF Annual Performance Report	NA[a]
MNA Annual Performance Report	NA[a]
ISB Pre-Final Inspection Report	March 2004

a. No enforceable date; planned date was July 2004.
ISB = in situ bioremediation
MNA = monitored natural attenuation
NA = not applicable
NPTF = New Pump and Treat Facility

The project was adequately funded to accomplish all required work, as well as a number of scientific and engineering tasks necessary to ensure effective and compliant operations in upcoming years.

In summary, the OU 1-07B project completed all operational and monitoring activities required for the NPTF and MNA remedies. The project met all enforceable milestones for submittal of primary and secondary documents. The combined FY 2003 accomplishments have ensured successful start of operations and ultimately support attainment of RAOs.

5. GENERATION OF SECONDARY WASTE

Listed waste was generated as a result of sampling activities and was managed in compliance with the requirements of the *Waste Management Plan for Test Area North Final Groundwater Remediation Operable Unit 1-07B* (INEEL 2002). Table 11 summarizes the quantities, volume of currently stored waste, waste determination, and current disposition of waste streams generated during FY 2003.

Table 11. Summary of waste generated and stored by the Operable Unit 1-07B remedial action operations during Fiscal Year 2003.

Waste Stream	Quantity Generated[a]	Currently Stored	Waste Determination[b]	Ultimate Disposition[c]
Sampling purge water	29,921 gal	—[d]	F001	NPTF
Debris (personal protective equipment and miscellaneous refuse)	3 drums	27 drums	F001	Off-Site TSDF/ICDF
Spent carbon	14 drums	—	F001	Off-Site TSDF/ICDF
TAN drill cuttings	10 small boxes 4 large boxes	15 small boxes 4 large boxes	F001	Off-Site TSDF/ICDF
Groundwater Treatment Facility piping and parts	8 large boxes	8 large boxes	F001	Off-Site TSDF/ICDF
Field laboratory waste (spent reagent, preserved samples, etc.)	1 drum	6 drums	F001, D002, D005, D006, D007	Off-Site TSDF/ICDF
Spent resin	—	6 drums	F001	Off-Site TSDF/ICDF
Spent multimedia filter	—	4 drums	F001	Off-Site TSDF/ICDF
Brass material	—	1 drum (20 gal)	F001	Off-Site TSDF/ICDF
Tracer test material	—	2 drums	F001	Off-Site TSDF/ICDF
Miscellaneous waste	1 drum (5 gal)	1 drum (30 gal) 1 drum (5 gal)	F001	Off-Site TSDF/ICDF

a. "Drums" indicate a 55-gal waste drum; however, actual waste volume may be less, as drums were not all filled completely. "Small boxes" indicate a 2 × 4 × 8-ft box; "large boxes" indicate a 4 × 4 × 8-ft box.
b. U.S. Environmental Protection Agency waste codes. F001 indicates TCE and other spent solvents; D002 indicates corrosive waste; D005 = barium; D006 = cadmium; D007 = chromium.
c. Waste is currently stored at the TAN CERCLA Waste Storage Facility.
d. Dash indicates either no waste was generated or is stored.
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
ICDF = INEEL CERCLA Disposal Facility
INEEL = Idaho National Engineering and Environmental Laboratory
NPTF = New Pump and Treat Facility
TAN = Test Area North
TCE = trichloroethene
TSDF = treatment, storage, and disposal facility

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